REVISION OF *AUSTRALOXENELLA* HOWDEN & STOREY IN AUSTRALIA (COLEOPTERA: SCARABAEIDAE: APHODIINAE)

R.I. STOREY & H.F. HOWDEN

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Australoxenella Howden & Storey, the only Australian member of the aphodiine tribe Stereomerini, is revised. Eleven species are described of which the following are new: *concinna, kalpara, midgee, mirreen, moogoon, peckorum, teeta, wurrook, zborowskii.* Relationships between species are discussed. Most new specimens were taken in flight intereception traps. No information is available on the biology of these suspected termitophiles. □ *Coleoptera, Scarabaeidae, Aphodiinae, Australoxenella, taxonomy.*

R.I. Storey, Department of Primary Industries, PO Box 1054, Mareeba, Queensland 4880, Australia; H.F. Howden, Department of Entomology, Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, Ontario K1P 6P4 CANADA; *received 20 September 1995.*

Australoxenella Howden & Storey, 1992 was erected for two unusual specimens representing two species of aphodiine Scarabaeidae taken in the far north of the Northern Territory. The Stereomerini was erected for *Australoxenella*, *Bruneixenus* Howden & Storey, and *Stereomera* Arrow and *Termitaxis* Krikken, previously placed in the tribe Rhyparini. Collecting in NT and in Queensland since 1992 has yielded 96 specimens of *Australoxenella*, including nine new species. Most were caught in flight interception traps, although several were from malaise traps and one from a berlesate. Habitat ranged from mixed eucalyptus woodland to dense rainforest. With revision of Australian Aphodiinae in progress (Stebnicka & Howden, 1994, 1995) revision of *Australoxenella* was necessary in light of the new material. Although Howden & Storey (1992) speculated that all Stereomerini were termitophiles, no direct evidence of this life habit in *Australoxenella* has surfaced.

METHODS AND MATERIALS

Terminology follows Howden & Storey (1992). Scale bars on SEM photographs are in millimetres. Collection abbreviations used are: ANIC–Australian National Insect Collection, Canberra, A.C.T.; HAHC–H. & A. Howden Collection, Ottawa, Ontario; ISEA–Institute of Systematics and Evolution of Animals, Cracow, Poland; NTMA–Northern Territory Museum of Arts and Sciences, Darwin; QMBA–Queensland Museum, Brisbane; QPIM–Department of Primary Industries, Mareeba, Queensland; SBPC –S. B. Peck Collection, Ottawa, Ontario.

SYSTEMATICS

Order COLEOPTERA
Family SCARABAEIDAE
Subfamily APHODIINAE

Australoxenella Howden & Storey, 1992

Australoxenella Howden & Storey, 1992:1811.

TYPE SPECIES. *Australoxenella humptydooensis* Howden & Storey, 1992.

DESCRIPTION. *Head.* Dorsally broad, flattened, feebly convex, about twice as wide as long. Clypeus anteriorly with broadly inflexed edge, obtusely angulate medially, nitid. Head dorsally, with distinct median and lateral grooves, length of median groove variable, lateral grooves slightly deeper, c. 1/3 of distance to outer edge of gena, length of lateral grooves variable, lateral grooves slightly convergent anteriorly for apical 1/4–2/3 length; surface of head dorsally, except for grooves, with close, appressed, circular scales giving granulate appearance. Gena not obviously delimited, inner edge indicated by small, non-granulate marking near summit of convex area.

Pronotum. Strongly, irregularly convex with transverse sulcus near middle, extending each side to at least lateral thirds, variable in length, depth and width; area anterior to sulcus with 5 or usually 7 longitudinal grooves, inner 5 grooves variable in depth and width, rounded ridges between grooves variable, inner 2 ridges often elevated and forming rounded prominence just anterior to transverse sulcus; equivalent median surface posterior to sulcus with only trace of

median groove, always strongly convex and more strongly elevated than any other part of dorsum; 3 variable lateral posterior grooves on each side parallel, and extending into sulcus; pronotum laterally with sides almost parallel; anterior angles slightly acute, posterior angles almost 90°, abruptly rounded; pronotal surfaces with close, appressed, circular scales, except grooves and sulcus. Scutellum minute, surface shining.

Elytron. Moderately to strongly ridged on disc, each elytron with sutural and 2–3 lateral intervals elevated with shallow to deep U-shaped depressions between; distinct striae absent or with one stria below feeble humeral umbone, usually merging with lateral bead near middle of lateral edge; epipleuron broadly inflexed, parallel-sided or tapering towards apex, often longitudinally concave near metacoxa; elytral apices not greatly modified, explanate in some species, conjointly broadly rounded; covered by close, appressed, circular scales, density variable, always numerous along crests of ridges and outside fourth ridge, scattered to dense on U-shaped depressions; depressions dull, alutaceous. Metathoracic wings long, functional.

Pygidium. Surface ventral, flattened, wider than long, with broadly rounded apex anterior in position.

Ventral surface. Antenna 9-segmented, club 3-segmented, equal in length to basal 6 segments of antenna combined; area surrounding antenna deeply concave. Mentum medially concave, anterior margin almost straight with small median projection. Maxillary palpus apparently 3-segmented, apical segment lanceolate. Mandibles thin, blade-like. Eye small, somewhat triangular, approximately 10 facets long x 18 wide, not visible dorsally, covered by pronotum when head retracted. Prosternum laterally with alutaceous to subnitid surface, anterior edge near antennae with a raised marginal bead; median prosternal process anteriorly strongly elevated, apex expanded, process posteriorly lanceolate, medially carinate, with obtusely angled sides. Mesosternum moderate in size, triangular, narrowed laterally. Metasternum between mesocoxae narrow, blade-like, posterior to mesocoxae abruptly widened, flat, shallowly concave in posterior median 1/2, anteriorly behind mesocoxae with transverse marginal bead, surface alutaceous to nitid; metacoxae contiguous. Abdomen with 4 (♂) or 5 (♀) segments visible medially, 6 visible laterally, apical segment longer in midline than other segments combined.

Legs. Femora wide, flattened. Protibia with 2 teeth on outer edge, one apical, one subapical, subapical occasionally obsolete. Meso- and meta-tibiae flattened, approximately twice as long as wide; outer narrow edge of each tibia with irregular longitudinal rows of punctures, each puncture with a minute yellowish seta; each tibia with 2 minute apical spurs, may be large setae; small apical setae also present. Protarsus 5-segmented, with several conspicuous setae at ventral apex of each segment; claws normal. Meso - and meta-tarsi 4-segmented, appearing to be 3-segmented, basal segment shorter than second segment; claws reduced in thickness.

KEY TO SPECIES OF *AUSTRALOXENELLA*

1 Pronotum anteriorly with median, longitudinal groove similar in width to groove on each side and nearly as wide as adjacent ridges; anteriorly with ridge on each side of median groove at most only slightly higher than adjacent ridge (Fig. 1A); elytral epipleura nearly constant in width to apices (except *teeta* sp.nov.) . . . . . (Group 1) 2

Pronotum anteriorly with median, longitudinal groove narrow, more so than lateral grooves; anteriorly with ridge on each side of median groove more strongly elevated posteriorly than adjacent outer ridge (Fig. 5C); elytral epipleura noticeably narrowing towards apices. . . . . (Group 2) 7

2 (1)Each elytron with sutural and three lateral ridges and a single stria in basal outer quarter 3

Each elytron with sutural and two lateral ridges, stria in basal outer quarter absent (Fig. 1B); N Qld . . . . . *concinna* sp. nov.

3 (2)Pronotal ridges anterior to transverse sulcus lacking clusters of erect spur-like setae 4

Pronotal ridges anterior to transverse sulcus each with four clusters of closely appressed, erect spur-like setae (Fig. 1C); N Qld . . . . . *zborowskii* sp. nov.

4 (3)Pronotum in lateral view with median conical prominence posterior to transverse sulcus much more strongly elevated than area anterior to sulcus; lateral pronotal and elytral margins lacking distinct fringe of yellowish setae 5

Pronotum in lateral view with median conical prominence posterior to transverse sulcus only slightly more elevated than area anterior to sulcus; lateral pronotal and elytral margins with distinct fringe of yellowish setae (Figs 1E, 1F); N Qld . . . . . *teeta* sp. nov.

5 (4)Elytron with crests of longitudinal ridges on disc narrow, subacute (Figs 3B, 3D) 6

Elytron with crests of longitudinal ridges on disc

rounded, broad; Bathurst Island, NT
. . . . . *A. bathurstensis* Howden & Storey

6 (5)Elytral surface anteriorly between suture and adjacent raised (sutural) ridge with 2 rows of scales; next depression between sutural ridge and first lateral ridge with close, irregular, transverse rows of five scales; narrower species, length to width ratio 2.2:1 (Fig. 3B); NT
. . . . . *moogoon* sp. nov.

Elytral surface near base between suture and adjacent raised (sutural) ridge with 3 irregular rows of scales; next depression between sutural ridge and first lateral ridge with close irregular, transverse rows of 6-8 scales; broader species, length to width ratio 2:1 (Fig. 3D); NT
. . . . . *wurrook* sp. nov.

7 (1)Pronotum in lateral third posterior to transverse sulcus transversely convex anterior to posterior margin 8

Pronotum in lateral third posterior to narrow transverse sulcus broadly, shallowly concave between sulcus and posterior margin (Fig. 4A); N Qld . . . . . *midgee* sp. nov.

8 (7)Posterior prosternal lanceolate process with central carina blade-like, very little expanded at middle (Fig. 2F); elytral U- shaped depressions with regular transverse rows of scales in fine grooves, remaining surface without scales or setae (Fig. 2E); N Qld . . . . . *kalpara* sp. nov.

Posterior prosternal lanceolate process with central carina expanded at middle (Fig. 5E); elytral U-shaped depressions with scales not grouped in transverse rows in fine grooves; NT
. 9

9 (8)Metasternum medially just posterior to mesocoxae with narrow transverse ridge with declivous posterior edge forming anteriorly-directed abrupt, obtuse angle (Fig. 5E); third lateral ridge on each elytron with inner parallel lines of scales 10

Metasternum medially just posterior to mesocoxae with broadened transverse ridge, posterior edge of ridge almost straight or feebly, anteriorly, arcuate medially (Fig. 4E); third lateral ridge on each elytron lacking inner parallel lines of scales (Fig. 4D); NT
. . . . . *peckorum* sp.nov.

10 (9)Meso- and meta-femora ventrally with numerous oval, appressed scale-like setae; elytra in lateral view with sutural ridges distinctly arcuately elevated at posterior third (Fig. 5B); NT
. . . . . *mirreen* sp. nov.

Meso- and meta-femora ventrally with scale-like setae present only near posterior edges, with scattered, slender setae elsewhere; elytra in lateral view with sutural ridges only feebly arcuately elevated at posterior third (Fig. 5D); NT
. . . . . *A. humptydooensis* Howden & Storey

Australoxenella concinna sp. nov.
(Figs 1A, 1B, 6A)

ETYMOLOGY. For the beautiful appearance.
MATERIAL EXAMINED. HOLOTYPE QMBT 13424 (sex not determined) from 17°24'S, 145°41'E, Westcott Rd, Topaz, Qld, 6.xii.1993-25.ii.1994, Monteith, Cook, Janetzki, RF intercept 680m.

DESCRIPTION. Length 2.9mm, greatest width 2.0mm. Dark reddish brown dorsally and ventrally.

Head. Median groove reaching anterior edge, lateral grooves reaching anterior edge and slightly converging for anterior 1/2; surface of head with small oval-elongate marking above each eye; anterior edge of head between genae with a fringe of short, adjacent, yellowish, flattened setae.

Pronotum. Four central anterior rounded ridges equal in size, none elevated; median, first and second lateral pairs of grooves equal in width and depth, third lateral pair of grooves fine, joining anterior pronotal edge c. 1/3 distance from anterior angles to centre line; posterior median groove not visible in anterior 1/2, adjacent rounded ridges slightly elevated, crest acute, additional fourth pair of lateral grooves present, strong from centre of sculptured area to posterior angles; transverse sulcus strong narrow, running to lateral edge of pronotum, slightly widened posteriorly for inner 1/2; widened area of sulcus bare, anterior edge of sulcus and most grooves with short adjacent yellowish setae, groups of longer similar setae in centre of sculptured area; small clusters of spur-like setae on anterior ridges and posterior prominence, not well developed; lateral pronotal edges from anterior angles to posterior angles with a distinctive fringe of adjacent, yellowish, flattened setae.

Elytron. Broad, flattened, explanate; with sutural and 2 lateral ridges, ridges weakly elevated, shortened, sutural longest c.2/3 length of elytron, second lateral shortest c.1/2 length of elytron; U-shaped depressions very shallow, barely detectable; entire dorsal surface of elytron with close, appressed, circular scales, crest of each ridge with a distinct row of adjacent, appressed, circular scales; lateral margin of elytron with a distinct fringe of adjacent, flattened, yellowish setae, this in the form of a double row on basal 1/6 which could indicate position of a vestigial stria; epipleuron wide, slightly narrowed in apical 1/6, nitid, punctures and setae fine, stronger in apical 1/2.

Pygidium. Nitid with small, setate punctures.

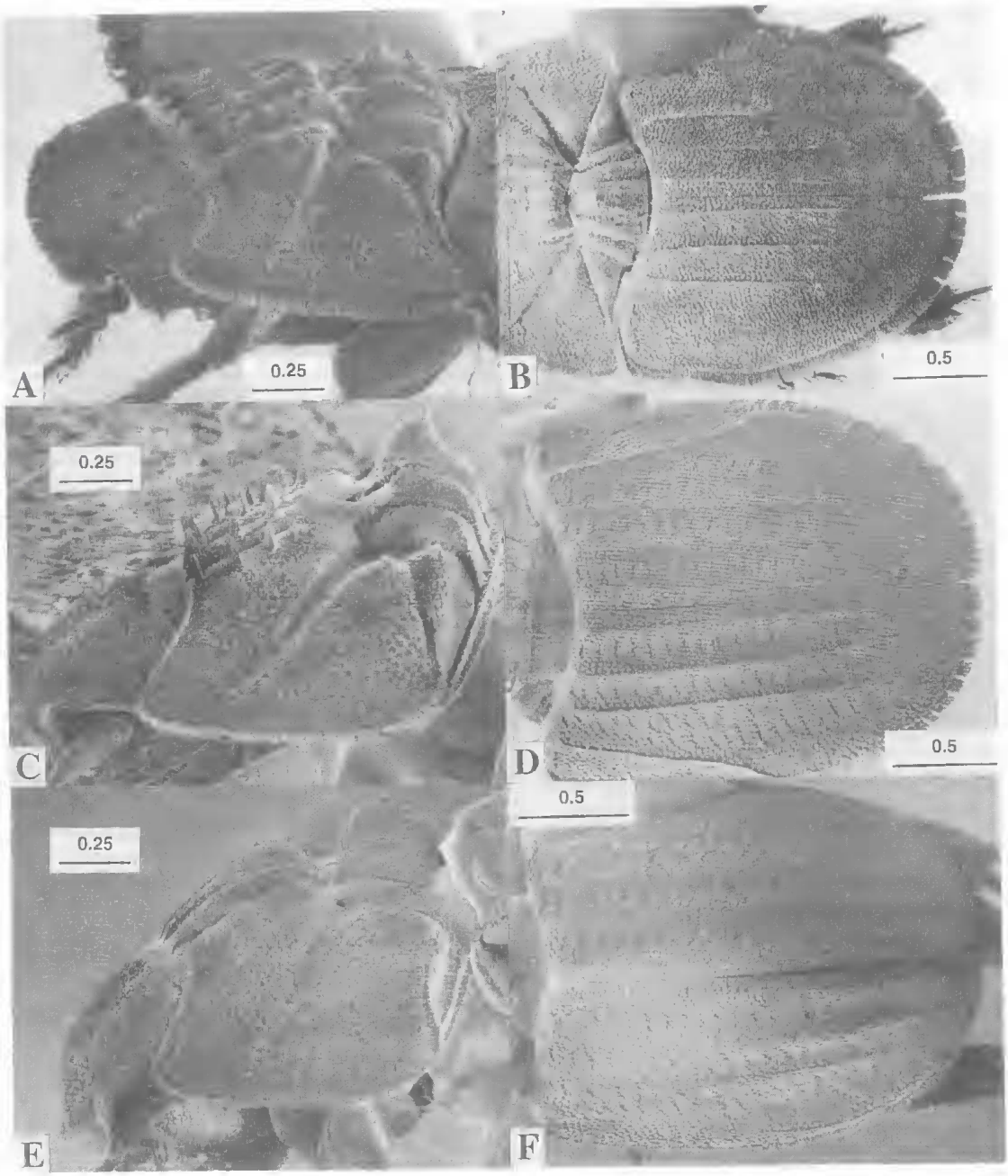

FIG.1. A,B, *Australoxenella concinna* sp. nov. A, head and pronotum, lateral view. B, pronotum and elytra, dorsal view. C,D, *Australoxenella zborowskii* sp. nov. C, head and pronotum, lateral view. D, elytra, dorsal view. E,F, *Australoxenella teeta* sp. nov. E, head and pronotum, lateral view. F, elytra, dorsal view.

Ventral surface and legs. Abdominal segments nitid, posterior 1/2 of large segment with small setate punctures; metasternum nitid, central area with small setate punctures; meso- and meta-femora nitid, ventral surfaces with fine setate punctures, more numerous on posterior 1/2; meso- and meta-tibiae nitid, a few fine setate punctures on outer 1/2, lower lateral margin of each metatibia with a row of short, adjacent, flattened setae.

COMMENTS. *Australoxenella concinna* sp. nov. is closest to *A. zborowskii* sp. nov., sharing with it the setal fringes on the pronotum and elytra, and the clusters of spur-like setae on the pronotal sculpturing. It differs from that species in the additional fringe of setae on the anterior margin of the head, the pronotal clusters being not as strongly developed, the elytra having circular scales over the entire surface and the lack of a third lateral pair of elytral ridges. *Australoxenella concinna* is the most southerly species of the genus; it was trapped in dense rainforest (G. Monteith, pers. comm). Several hundred trap-months using flight interception traps by the senior author in many similar Atherton Tablelands sites over many years have failed to capture further specimens.

Australoxenella zborowskii sp. nov.
(Figs 1C, 1D, 6A)

ETYMOLOGY. For Paul Zborowski, collector of several species described in this paper.
MATERIAL EXAMINED. HOLOTYPE ANIC113, sex not determined, from 11° 41'S, 142° 42'E, 14km ENE of Heathlands, Qld, 21.i.-19.ii.1994, P. Zborowski, flight intercept trap.

DESCRIPTION. Length 2.6mm, greatest width 1.4mm. Reddish brown dorsally and ventrally.

Head. Three grooves all reaching anterior edge, lateral grooves converging slightly for apical 1/3 length; surface of head with narrow, elongate, nitid marking above each eye.

Pronotum. Sculptured area anterior to transverse sulcus wider, about 1/2 width of pronotum, grooves strong, intergroove rounded ridges of equal height, not raised around median groove, third lateral pair of grooves weak, almost reaching anterior angles; prominence around median groove posterior to transverse sulcus strong, apex acute, additional fourth pair of lateral grooves present, running from middle portion of sulcus almost to posterior angles; transverse sulcus constant in width, narrowing towards apices, almost reaching lateral edges of pronotum; grooves nitid, middle region of sulcus with prominent yellow setae; pronotal disc with spur-like clusters of erect, yellow setae - four groups on each of the four narrow anterior ridges, five each on adjacent wider ridges, less obvious clusters on posterior central prominence and posterior lateral raised areas; lateral pronotal edges from anterior angles to just past posterior angles each with a distinct fringe of short, adjacent, flattened, yellowish setae.

Elytron. Disc flattened, explanate, ridges not very high and U- shaped depressions shallow; with sutural and three lateral ridges, sutural ridge very slightly stronger, third lateral ridge strong, running from base to c. 3/8 distance along lateral margin of elytron; area of elytron outside stria c.1/2 as wide as in most other species; dorsal surface outside third lateral ridge with close, appressed, circular scales, scales also numerous along remaining margin of elytron and up to apices of elytral ridges, crest of each elytral ridge with a single row of overlapping scales along entire length resulting in a carinate appearance; U-shaped depressions between lateral ridges with regular transverse, single, occasionally double, rows of scales joining ridges; lateral margin of elytron from base to apex with a distinct fringe of short, adjacent, flattened yellowish setae; lateral stria also with a reduced fringe row; epipleuron broad, slightly narrowed at apex, bare, nitid.

Pygidium. Smaller than in other species, with scattered setate punctures.

Ventral surface and legs. Meso- and meta-tibiae with a few minute setate punctures, posterior outer margin with a short setal fringe; ventral surfaces of meso- and meta-femora with scattered, medium, setate punctures.

COMMENTS. This species is known from a single specimen taken in notophyll vine forest in a flight interception trap (P. Zborowski, pers. comm.). Characters separating *A. zborowskii* sp. nov. are discussed under *A. teeta* sp. nov. and *A. concinna* sp. nov. The distinctive pronotal and elytral fringes of flattened setae are found only in three Queensland species, *A. zborowskii*, *A. teeta* and *A. concinna*.

Australoxenella teeta sp. nov.
(Figs 1E, 1F, 6A)

ETYMOLOGY. An Aboriginal word for insect.
MATERIAL EXAMINED. HOLOTYPE ANIC114, sex not determined, from 13° 39'S, 142° 40'E (GPS), 2km N Rokeby, Qld, 15.ii.-18.iii.1994, P. Zborowski & M. Shaw, flight intercept trap.

DESCRIPTION. Length 2.6mm, greatest width 1.3mm. Reddish brown dorsally and ventrally.

Head. Median groove almost reaching anterior edge, lateral grooves slightly shorter and converging for anterior 1/2; surface of head with small elongate, nitid marking above each eye.

Pronotum. Anterior rounded ridges adjacent to median groove weakly elevated posteriorly, third lateral pair of grooves weak, almost straight to

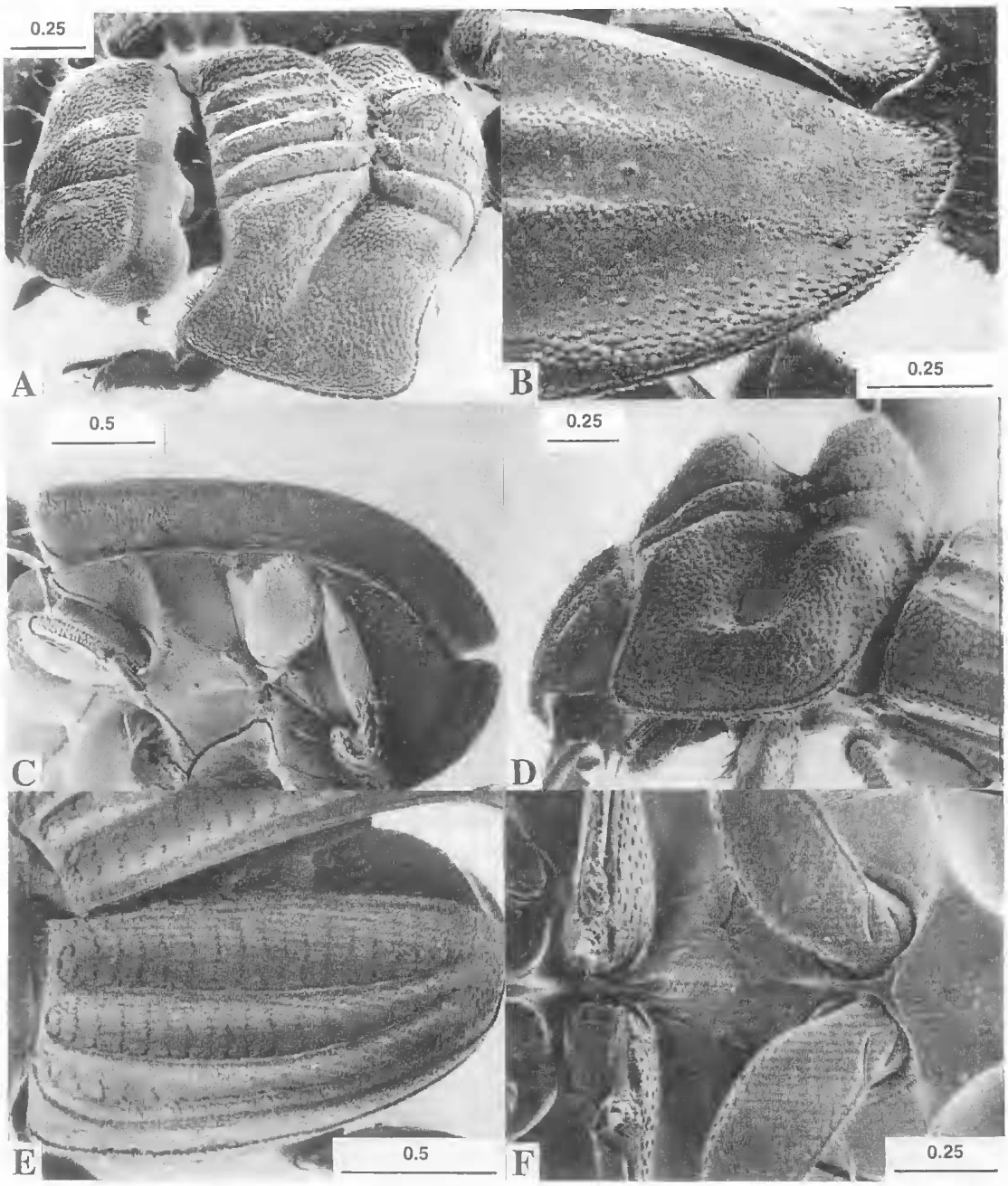

FIG.2. A-C, *Australoxenella bathurstensis* Howden & Storey. A, head and pronotum, dorsolateral view. B, elytral apex, dorsolateral view. C, posterior half, ventral view. D-F, *Australoxenella kalpara* sp. nov. D, head and pronotum, lateral view. E, elytron, dorsal view. F, mesosternum, ventral view. (Figs 2A,B from Howden & Storey,1992)

anterior angles; ridges adjacent to median groove posterior to transverse sulcus forming an elevated prominence, median groove not visible anteriorly; transverse sulcus not widened at apices, sulcus reaching 3/4 distance to lateral edge of pronotum from centre line; sulcus medially and centre of

sculptured area with dense, yellow setae; lateral pronotal edges from anterior angles to just past posterior angles with a distinct fringe of short, adjacent, flattened, yellowish setae.

Elytron. Disc with sutural and three lateral ridges, ridges not strong, sutural ridge most developed, third lateral ridge reduced and meeting margin of elytron about 1/2 distance to apex; lateral stria reaching margin of elytron about 3/8 distance to apex; dorsal surface outside of third lateral ridge with close, appressed, circular scales, crests of other ridges also with scales including a row of adjacent scales on crest of sutural and first lateral, U-shaped depressions between lateral ridges with spaced, transverse, single rows of scales joining ridges, surface dull, bare between; margin of elytron from base to apex with a distinct fringe of short, adjacent, flattened, yellowish setae; epipleuron narrowing only slightly towards apex, surface bare, subnitid.

Pygidium. Nitid with only scattered setate punctures.

Ventral surface and legs. Tibiae wide, flattened, nitid, impunctate on broad surfaces; femora broad, nitid, ventral surfaces of meso- and meta-femora with numerous setate punctures.

COMMENTS. *Australoxenella teeta* sp. nov. was taken in open forest in a flight interception trap set in red earth woodland dominated by *Eucalyptus tetradonta* and *E. mesophila* (P. Zborowski, pers. comm.) The border fringe of flattened setae on the lateral edges of the pronotum and elytra are well developed only in *A. teeta*, *A. concinna* sp. nov. and *A. zborowskii* sp. nov. All three species are nitid ventrally and have the prominence on the pronotal surface anterior to the transverse sulcus very reduced or absent. *Australoxenella zborowskii* and *A. concinna* have the elytra more explanate, the setal fringes slightly longer, the sculptured area in front of the pronotal transverse sulcus wider and less raised and prominent clusters of spur-like setae on the anterior pronotal ridges, allowing easy separation from *A. teeta.*

Australoxenella bathurstensis Howden & Storey, 1992
(Figs 2A-C, 6B)

Australoxenella bathurstensis Howden & Storey, 1992:1813.

MATERIAL EXAMINED. HOLOTYPE NTMAI287, from Cape Fourcroy, Bathurst Island, NT, 26.x.-3.xi.1979, P. Horner & I. Archibald.

DESCRIPTION. Length 3.2mm, greatest width 1.6mm. Brown dorsally, reddish brown ventrally.

Head. Median groove reaching 3/4 distance to anterior edge, lateral grooves slightly shorter and slightly converging for anterior 1/2; surface of head with narrow, elongate marking above each eye.

Pronotum. Median, first and second lateral pairs of grooves anterior to transverse sulcus strong, equal in depth and width, third lateral pair of grooves fine, joining anterior edge of pronotum c.1/3 distance from anterior angles to centre line, anterior four central ridges strong, rounded, equal in height and width; median groove posterior to transverse sulcus barely visible on posterior half only, first lateral pair stronger, second and third lateral pairs strongest, ridges either side of median groove forming strong prominence, crest rounded; transverse sulcus narrow, barely widened toward centre; area between anterior and posterior sculpturing with groups of appressed, yellow setae.

Elytron. Broad, flattened, explanate; sutural and three lateral ridges not strong, crests low, rounded, third lateral ridge forming lateral margin of elytron just past 1/2 distance to apex; lateral stria joining lateral margin of elytron just before 1/2 distance to apex; close, appressed, circular scales cover surface outside third lateral ridge and along crests of all four ridges, U-shaped depressions with few scattered scales mostly in basal 1/2, surface of depressions dull; epipleuron widened to apex, dull to subnitid on apical 1/3, circular scales along outer margin.

Pygidium. Subnitid with scattered small setate punctures,setae fine, flattened.

Ventral surface and legs. Abdominal segments, metasternum, and meso- and meta- femora subnitid with scattered small punctures each with a fine seta, meso- and meta-tibiae subnitid, with setate punctures only near outer margins.

COMMENTS. *Australoxenella bathurstensis* Howden & Storey can be distinguished from the other species of Group 1 by the form of the elytra, with all ridges low and rounded, with associated scales unordered, and largely bare U-shaped depressions. It is still known only from the holotype.

Australoxenella moogoon sp. nov.
(Figs 3A, 3B, 6B)

ETYMOLOGY. An Aboriginal word for beetle.

MATERIAL EXAMINED. HOLOTYPE ANIC115, sex not determined, from 33km E of Jabiru, Arnhem-

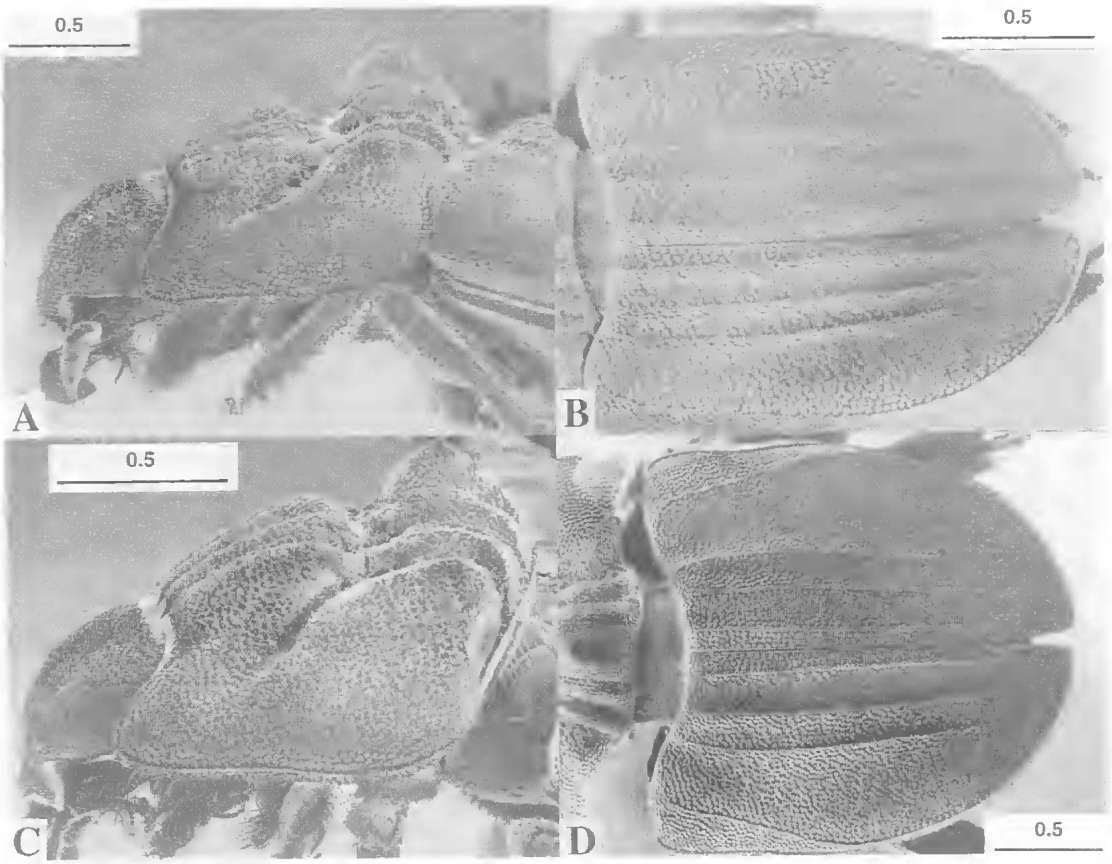

FIG.3. A,B, *Australoxenella moogoon* sp. nov. A, head and pronotum, lateral view. B, elytra, dorsal view. C,D, *Australoxenella wurrook* sp. nov. C, head and pronotum, lateral view. D, elytra, dorsal view.

land, NT, 15-23.xii.1993, S. & J. Peck, 93-130, 5 FITs, Podocarp Canyon, rainforest. PARATYPES (5) in HAHC, QPIM, same data as Holotype.

DESCRIPTION. Length 2.4–2.5mm, greatest width 1.3-1.4mm. Reddish brown dorsally, slightly lighter ventrally.

Head. Median groove almost reaching anterior edge, lateral grooves slightly shorter and slightly converging for anterior 1/2; surface of head with narrow elongate marking above each eye.

Pronotum. Anterior rounded ridges adjacent to median groove only very slightly elevated posteriorly, four ridges and median, first and second lateral pairs of grooves equal in appearance, third lateral pair of grooves fine reaching anterior pronotal edge c.1/3 distance from anterior angles to centre line; ridges either side of median posterior groove forming a subacute prominence, anterior portion of median groove scarcely visible, other grooves strong; transverse sulcus strong, slightly widened to c.2/3 distance to apices; apical 1/3 of anterior grooves, second and third lateral posterior grooves, widened section of sulcus bare, nitid; apices of both anterior and posterior ridges near centre of pronotum with close, appressed, yellowish setae.

Elytron. Broad, flattened; disc with sutural and three lateral ridges, sutural, first and second lateral ridges similar in development, not strongly raised, third lateral ridge stronger joining lateral margin of elytron c.2/3 distance to apex; lateral stria joining margin of elytron c.1/2 distance to apex; crests along length of all ridges each with single row of adjoining, circular scales, less distinct on third lateral; rest of surface with circular, appressed scales densest outside third lateral ridge, fairly dense inside third lateral towards second lateral ridge, rest of surface with scales most numerous towards crests of ridges; epipleuron wide to apex, subnitid with scales only towards outer margin.

Pygidium. Nitid with scattered, small setate punctures.

Ventral surface and legs. Abdominal segments, metasternum, mid and hind legs nitid, abdominal segments, centre of metasternum and meso- and meta-femora with scattered small, setate punctures.

COMMENTS. *Australoxenella moogoon* sp. nov. is a member of Group 1 species group and does not have a pronotal prominence anterior to the transverse sulcus and has the elytral ridges low and capped with a single row of adjacent circular scales. It is closest to *A. wurrook* sp. nov. and the two species can be separated by characters listed in the key to species. *Australoxenella wurrook* and *A. moogoon* were taken at the same locality and series of flight interception traps but not necessarily in the same trap.

Australoxenella wurrook sp. nov.
(Figs 3C, 3D, 6B)

ETYMOLOGY. An Aboriginal word for flat.
MATERIAL EXAMINED. HOLOTYPE ANIC116, sex not determined, from 33km E of Jabiru, Arnhemland, NT, 15-23.xii.1993, S. & J. Peck, 93-130, 5 FITs, Podocarp Canyon, rainforest. Paratype in HAHC, same data as Holotype.

DESCRIPTION. Length 2.8–3.1mm, greatest width 1.6–1.7mm. Dark reddish brown dorsally, slightly lighter ventrally.

Head. Median groove reaching anterior edge, lateral grooves falling short of anterior edge and slightly converging on anterior 1/3; surface of head with moderately long, narrow marking above each eye; anterior edge of dorsal surface of head with an indistinct fringe of very short flattened setae.

Pronotum. Four central anterior rounded ridges of equal height, median, first and second lateral pairs of grooves of equal width and depth, third lateral pair of grooves fine reaching anterior pronotal edge c.1/3 of distance from anterior angles to centre line; pronotal surface adjacent to posterior median groove elevated, crest of prominence acute, median groove not visible in anterior 1/2, strong in posterior 1/2; transverse sulcus long, narrow, visible for 4/5 distance to lateral pronotal edges, surface of sulcus bare, nitid; pronotal surface except for sulcus and small area between anterior and posterior sculpturing, covered in close, appressed, circular scales, denser in five central anterior grooves, groups of dense, yellowish setae at anterior ends of posterior grooves; lateral pronotal edges between anterior and posterior angles with indistinct fringe of very short, flattened setae.

Elytron. Wide, flattened, length to width ratio about 2:1; sutural and three lateral ridges visible, not high, sutural ridge not raised near posterior end, equivalent in height to first and second lateral ridges, third lateral ridge weaker, shorter, almost reaching lateral margin of elytron c.3/8 distance to apex then running parallel to margin towards apex; lateral stria strong, short, reaching lateral margin of elytron just before third lateral ridge; entire surface of elytron densily covered with close, appressed, circular scales, these in the form of a single row of adjacent scales along crest of each elytral ridge; epipleuron broad all the way to apex, nitid, with scales only towards outer margin.

Pygidium. Smaller, nitid with scattered setate punctures.

Ventral surface and legs. Ventral surface nitid, last abdominal segment and meso- and meta-femora moderately punctate, punctures with short, fine setae.

COMMENTS. *Australoxenella wurrook* sp. nov. is closest to three new Queensland species, *A. zborowskii* s, *A. concinna*, and *A. teeta*. It lacks the elytral fringes of flattened setae found in the three Queensland species though it does have very short fringes on the anterior of the head and lateral pronotal edges. The circular scales in the U-shaped elytral depressions are not arranged in evenly spaced transverse rows. The pronotal clusters of spur-like setae on *A. zborowskii* and *A. concinna* are absent in *A. wurrook*, and the elytra of *A. teeta* are much less flattened than *A. wurrook*. The two specimens of *A. wurrook* were taken in flight interception traps at Podocarp Canyon near Jabiru, N.T., in rainforest. *A. moogoon* sp. nov. was also taken at this site but not necessarily in the same traps as *A. wurrook*.

Australoxenella midgee sp. nov.
(Figs 4A, 4B, 6A)

ETYMOLOGY. An Aboriginal word for small.
MATERIAL EXAMINED. HOLOTYPE ANIC117, sex not determined, from 11° 51'S, 142° 38'E, 12km SSE of Heathlands, Qld, 16.i.1992, T.A. Weir & I.D. Naumann, Berlesate ANIC 1214 closed forest litter.

DESCRIPTION. Length 2.4mm, greatest width 1.3mm. Dark reddish brown dorsally and ventrally.

Head. Median groove reaching anterior edge,

lateral grooves slightly shorter and slightly converging for anterior 1/2; surface of head with narrow, elongate, nitid marking above each eye.

Pronotum. Anterior rounded ridges adjacent to median groove strongly elevated, the resulting prominence as high as prominence posterior to transverse sulcus, first lateral pair of anterior grooves barely visible, third lateral pair of anterior grooves very weak, meeting anterior pronotal edge c.1/3 distance from anterior angles to centre line; posterior grooves not strong, ridges adjacent to median groove forming an elevated prominence; transverse sulcus not widened at apices; pronotal areas posterior to sulcus and adjacent to median sculpturing depressed, concave, the lateral margins of depressed areas forming costae parallel to lateral pronotal edges.

Elytron. Disc with sutural and three lateral ridges, sutural and third lateral ridges strongest, sutural ridge slightly raised in posterior 1/3; lateral stria not quite reaching lateral margin of elytron c.1/2 distance to apex; dorsal surface outside of third lateral ridge with close, appressed, circular scales, crests of other ridges with similar scales; U-shaped depressions between ridges with regular, transverse, rows of scales joining the ridges, apparently in slight depressions, surface bare, dull between; epipleuron narrowing towards apex, surface dull, bare except with scales along outer margin.

Pygidium. Dull with small dense setate punctures covering entire surface.

Ventral surface and legs. Abdominal segments, legs and centre part of metasternum dull with numerous setate punctures, setae less scale-like than those on dorsal surface; meso- and metatibiae and femora less flattened than in other species of the genus.

COMMENTS. *Australoxenella midgee* sp. nov. and *A. kalpara* sp. nov. are the Group 2 Queensland species closest to *A. humptydooensis* Howden and Storey. *Australoxenella midgee* can easily be separated from the latter species by the shape of the pronotum, the transverse rows of scales on the elytral depressions, and narrower tibiae. The only known specimen was taken in a berlesate sample of litter from closed forest.

Australoxenella kalpara sp. nov.
(Figs 2D-F, 6A)

ETYMOLOGY. An Aboriginal word for bed of a river.

MATERIAL EXAMINED. HOLOTYPE ANIC118, sex not determined, from 15° 11'S, 143° 52'E (GPS), Hann River, Qld, 18.xii.1993- 14.i.1994, P. Zborowski & E.D. Edwards, flight intercept trap.

DESCRIPTION. Length 2.3mm, greatest width 1.2mm. Dark reddish brown dorsally, slightly lighter ventrally.

Head. Median groove almost reaching anterior edge, lateral grooves slightly shorter and slightly converging for anterior 1/2; surface of head with small, narrow, elongate, dull marking above each eye.

Pronotum. Anterior rounded ridges adjacent to median groove strongly elevated, the resulting prominence almost as high as prominence posterior to transverse sulcus, median and first lateral pair of grooves only slighty reduced, third lateral pair of grooves very finely impressed, reaching anterior pronotal edge c. 1/3 distance from anterior angles to centre line; transverse sulcus broad, joined by similar depression running from posterior pronotal edge just outside pronotal sculpturing posterior to sulcus; transverse sulcus and wide grooves from posterior pronotal edge bare, dull, area between two pronotal prominences with close, appressed, yellowish setae.

Elytron. Disc with sutural and three lateral ridges all strong, sutural ridge elevated slightly on posterior 1/3, crest of third lateral ridge with fine groove along inner edge resulting in a doubled appearance; lateral stria strong, meeting lateral margin of elytron c.1/2 distance to apex; crests of sutural, first and second lateral ridges each with single row of adjacent circular scales, additional scattered scales along outer edges of these ridges, close, appressed, circular scales from the third lateral ridge to lateral margin of elytron except along centre of third lateral ridge, just inside the lateral stria and just inside basal 1/4 of margin; U-shaped depressions between ridges with regular transverse rows of adjacent, circular scales, rest of surface bare, dull; epipleuron strongly narrowing towards apex, surface dull, bare except scales along outer margin.

Pygidium. Subnitid with numerous punctures separated by about one diameter, each with a small elongate scale.

Ventral surface and legs. First four abdominal segments and metasternum dull, last visible abdominal segment, meso- and meta-femora and tibiae subnitid; abdominal segments, femora and centre portion of metasternum with scattered, elongate, appressed setae or scales; carinate crest of lanceolate posterior prosternal process not widened near centre.

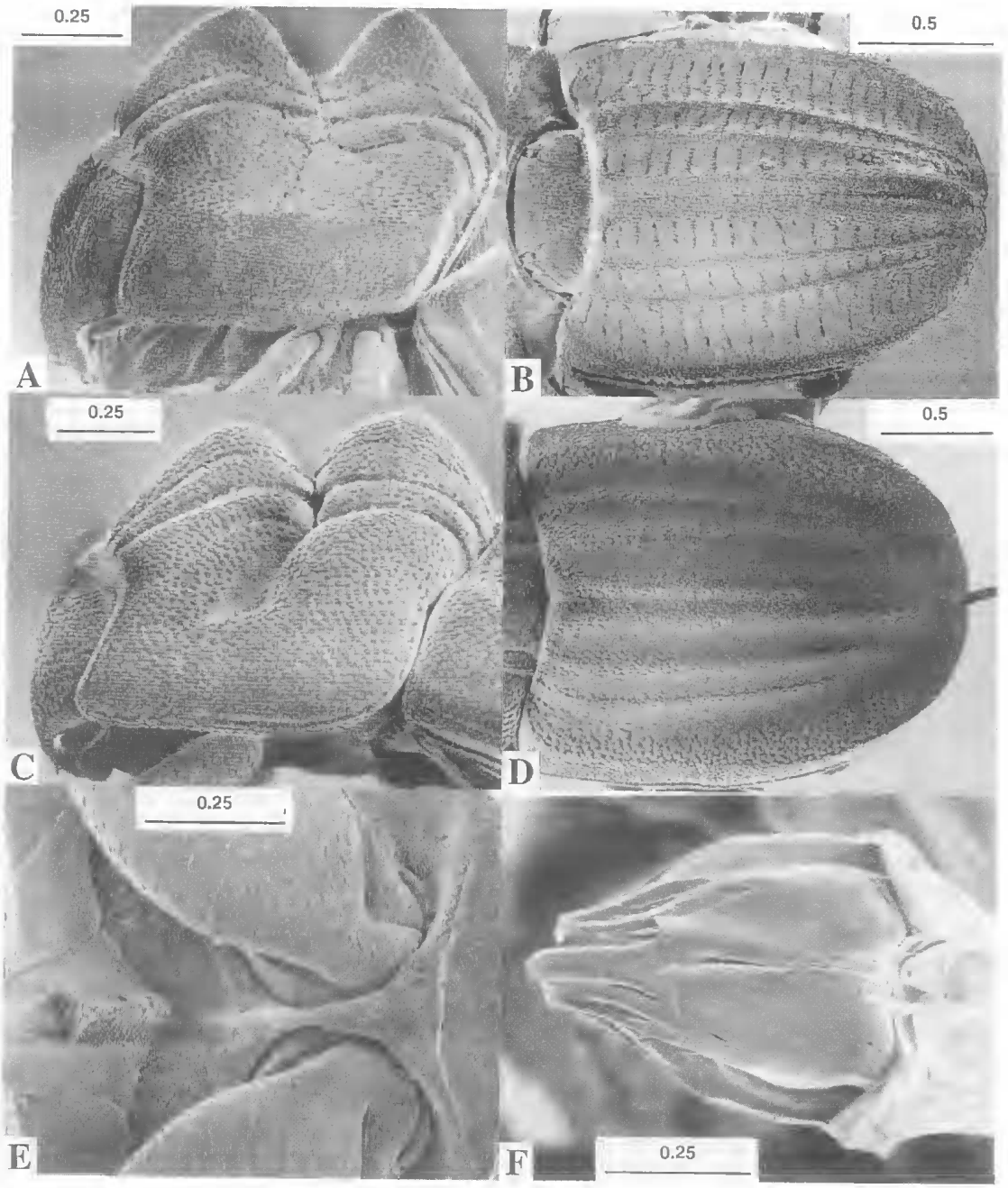

FIG.4. A,B, *Australoxenella midgee* sp. nov. A, head and pronotum, lateral view. B, elytra, dorsal view. C-F, *Australoxenella peckorum* sp. nov. C, head and pronotum, lateral view. D, elytra, dorsal view. E, mesosternum, ventral view. F, male genitalia, dorsal view.

COMMENTS. *Australoxenella kalpara* sp. nov. is closest to *A. midgee* sp. nov., also from Cape York Peninsula. The two species can be separated by pronotal sculpture, reduced punctation on the pygidium in *A. kalpara* and the blade-like shape of the central crest of the prosternal lanceolate process in *A. kalpara*. The habitat was riverine open woodland dominated by *Melaleuca* and *Leptospermum* (P. Zborowski, pers. comm.).

Australoxenella peckorum sp. nov.
(Figs 4C-F, 6B)

ETYMOLOGY. For the collectors of most of the new specimens in this study, Stewart and Jarmila Peck of Ottawa, Canada.

MATERIAL EXAMINED. HOLOTYPE ANIC119, sex not determined, from Kakadu N.P., Kapalga Res. Stn, NT, 11-25.xii.1993, S. & J. Peck, 93-118 FIT eucalypt woodland. PARATYPES same data as Holotype, (10); N.T.: Kakadu N.P., Kapalga Station Gabarlgu, 25. xii.- 7.i.1994, S. & J. Peck, 93-137 FIT rainforest, (2); Kakadu N.P., S. Alligator River, Gungarce rainforest trail, 12-25.xii.1993, S. & J. Peck, 93-120 FIT I, (3), same data except 93-121 FIT II, (5), same data except 25.xii.-6.i.1994, S. & J. Peck, 93-141 FIT I, (1). Paratypes in HAHC, QPIM, NTMA, SBPC.

DESCRIPTION. Length 2.3-3.0mm, greatest width 1.2-1.6mm. Reddish brown dorsally and ventrally.

Head. Median groove reaching or almost reaching anterior edge, lateral grooves reaching 2/3 distance to anterior edge, converging slightly for apical 2/3; surface of head with small elongate marking above each eye.

Pronotum. Anterior rounded ridges adjacent to median groove raised posteriorly to form a prominence almost as high as prominence posterior to transverse sulcus, median and first lateral pairs of grooves reduced, third lateral pair of grooves fine, middle 1/3 often not visible reaching anterior edge of pronotum c.1/3 distance from anterior angles to centre line; posterior prominence strong, apex rounded, median groove weakly visible on posterior half only, first pair of lateral grooves not very deep; transverse sulcus strong, widened almost entire length.

Elytron. Disc with sutural and three lateral ridges, sutural ridge only slightly raised posteriorly, second lateral ridge not strong, third lateral strong reaching almost to apex of elytron, crests of sutural, first and second lateral ridges rounded; lateral stria strong, reaching lateral margin of elytron almost 1/2 distance to apex; close, appressed, circular scales on elytron largely confined to area outside third lateral ridge and near crests of other ridges, U-shaped depressions and area near apex almost bare, dull; epipleuron narrowed towards apex, dull, bare except near outer margin which has close, appressed, circular scales.

Pygidium. Dull with scattered, medium punctures, setae indistinct.

Ventral surface and legs. Abdominal segments dull with scattered, medium-sized punctures, setae indistinct; metasternum dull, punctures and setae of central portion indistinct; meso- and meta-femora with scattered medium-sized setate punctures; metasternum medially just posterior to mesocoxae with broadened transverse ridge, the posterior edge of which is almost straight to feebly, anteriorly, arcuate medially.

Male genitalia as in Fig. 4F.

COMMENTS. The shape of the posterior edge of the transverse ridge of the metasternum which is an almost straight line (instead of an anteriorly directed, abrupt, obtuse angle) allows separation of *A. peckorum* sp. nov. from the other members of Group 2 *Australoxenella* species. The long series was taken at several sites within Kakadu National Park, N.T., using flight interception traps set in eucalyptus woodland and rainforest.

Australoxenella mirreen sp. nov.
(Figs 5A, 5B, 6B)

ETYMOLOGY. An Aboriginal word for south.

MATERIAL EXAMINED. HOLOTYPE ANIC120, sex not determined, from Litchfield N.P., Pethricks Rainforest, NT, 8-30.xii.1993, S. & J. Peck, 93-110 FIT deep rainforest. Paratypes same data as Holotype, (1); N.T.: Litchfield N.P., Wangi Falls, 8- 30.xii.1993, S. & J. Peck, 93-113 FIT deep rainforest, (1). Paratypes in HAHC.

DESCRIPTION. Length 2.4-2.6mm, greatest width 1.3-1.4mm. Dark reddish brown dorsally and ventrally.

Head. Median groove reaching 3/4 distance to anterior edge, lateral grooves slightly shorter and slightly converging for anterior 2/3; surface of head with small oval marking above each eye.

Pronotum. Anterior rounded ridges adjacent to median groove raised posteriorly to form a prominence almost as high as prominence posterior to transverse sulcus, median groove slightly reduced towards apex of prominence, first and second lateral pairs of grooves strong, third lateral pair of grooves finer, reaching anterior pronotal edge c.1/3 distance from anterior angles to centre line; posterior prominence strong, apex rounded, median groove not visible for anterior 1/3, first lateral pair of grooves slightly stronger, second lateral pair stronger still; transverse sulcus strong, widened for most of length.

Elytron. Disc with sutural and three lateral ridges strong, sutural ridge strongly raised posteriorly, three lateral ridges about same height, third lateral ridge slightly longer joining lateral margin of elytron c.4/5 distance to apex;

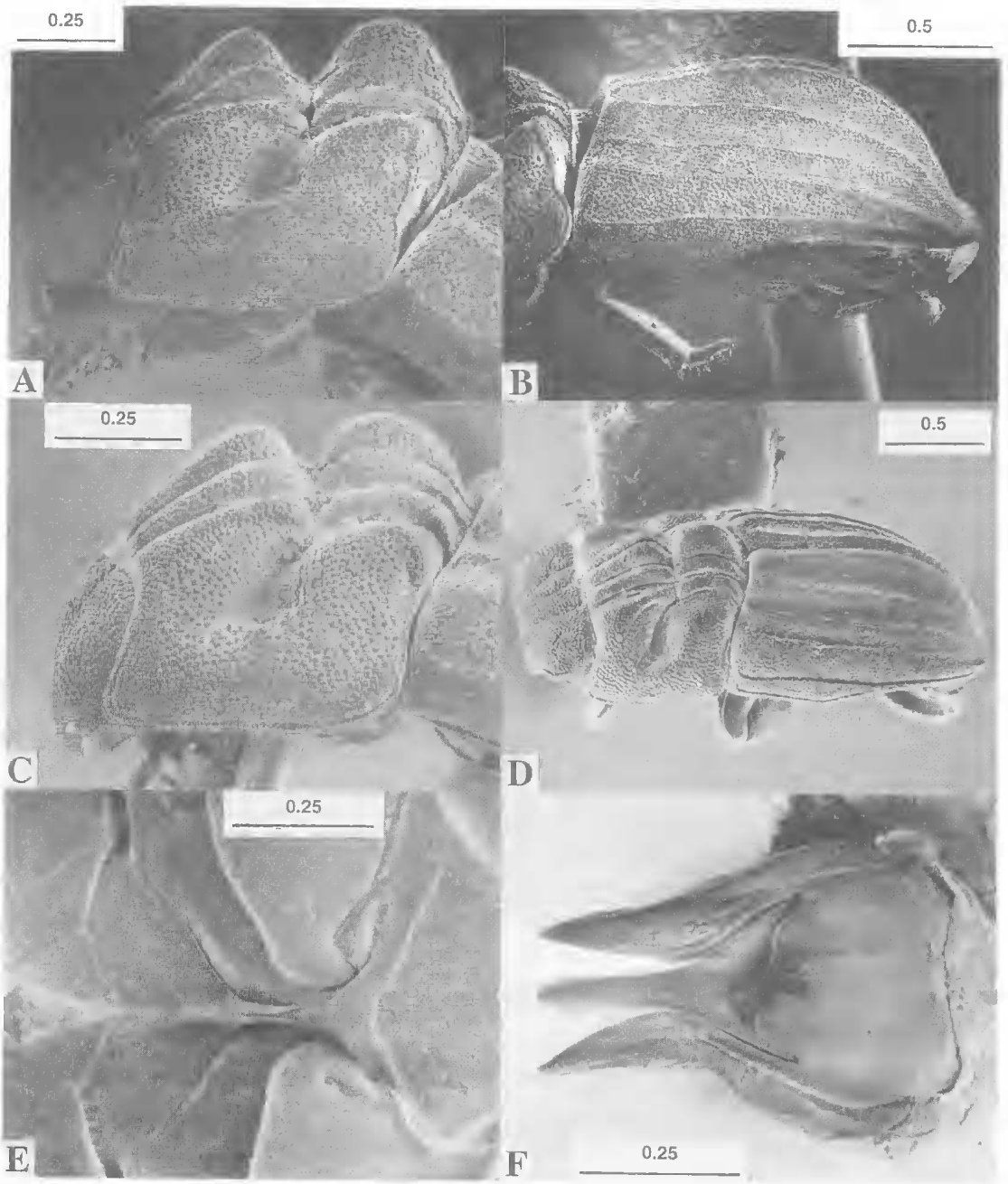

FIG.5. A,B, *Australoxenella mirreen* sp. nov. A, head and pronotum, lateral view. B, elytron, lateral view. C-F, *Australoxenella humptydooensis* Howden & Storey. C, head and pronotum, lateral view. D, dorsolateral view. E, mesosternum, ventral view. F, male genitalia, ventral view. (Fig.5D from Howden & Storey,1992).

lateral stria strong, joining lateral margin of elytron c.2/3 distance to apex; surface outside third lateral ridge and near crests of all ridges with close, appressed, circular scales, these reduced in number in U-shaped depressions and especially near apex; epipleuron narrowed near apex, surface dull bare, except near outer margin which has close, appressed, circular scales.

Pygidium. Dull with indistinct scattered setate punctures.

Ventral surface and legs. Abdominal segments dull with indistinct scattered setate punctures; metasternum dull, centre portion with indistinct setate punctures; meso- and meta- femora dull with scattered setate punctures.

COMMENTS. *Australoxenella mirreen* sp. nov., from Litchfield National Park, west of Adelaide River, is similar to *A. humptydooensis* from the Darwin area. The two species are separable with difficulty by the characters mentioned in the key to species.

Australoxenella humptydooensis Howden & Storey, 1992
(Figs 5C-F, 6B)

Australoxenella humptydooensis Howden & Storey 1992:1813.

MATERIAL EXAMINED. HOLOTYPE QMBAT12146, 6km E Humpty Doo, 6-19.x.1990, R.I. Storey, at U.V. light. Other material (51): N.T.: Darwin, CSIRO McMillans Rd, 1-25.xii.1993, S. & J. Peck, mixed eucalypt woodland 93-87 FIT, (40), same data except 25.xii-10.i.1994, mix. euc. woodlot 93-148 FIT, (3); 50km S Darwin, Berry Spg.Pk, 4-27.xii.1993, S. & J. Peck, 93-99 rainforest malaise, (7), same data except 27.xii.-3.i.1994, 93-154 rainforest FIT, (1). Specimens in ANIC, HAHC, ISEA, QPIM, QMBA, SBPC.

DESCRIPTION. Length 2.2–2.6mm, greatest width 1.1–1.4mm. Dark reddish brown dorsally and ventrally.

Head. Median groove reaching close to anterior edge, lateral grooves slightly shorter and slightly converging for anterior 1/2; surface of head with small oval-elongate marking above each eye.

Pronotum. Median anterior groove slightly reduced, especially posteriorly, apical 1/2 of third lateral pair of grooves fine, joining anterior pronotal edge c.1/3 distance from apical angles to centre line, two median anterior, rounded ridges raised posteriorly to form a prominence, not as high as prominence posterior to transverse sulcus; median groove posterior to sulcus fine, sometimes not visible in anterior 1/2, rounded ridges either side of median groove expanded to form a prominence, with crest rounded; transverse sulcus deep, widened posteriorly for c.3/4 length.

Elytron. Disc with sutural and three lateral ridges, sutural ridge slightly raised in middle 1/3, first lateral ridge strong, basal 1/2 highest, second lateral ridge weaker, third lateral ridge weak, joining lateral margin of elytron c.4/5 distance to apex; lateral stria reaching margin of elytron c.1/2 distance to apex; close, appressed, circular scales on surface of elytron outside of third lateral ridge, just inside third lateral ridge except for a fine, bare groove on basal 1/2, second lateral ridge rounded with scales on outside, inside bare with fine groove, crest of first lateral ridge rounded with scales over most of length, a slight inner groove on apical 1/3, sutural ridge rounded with scales over entire length. U-shaped depressions and apex of elytron dull with only scattered scales; epipleuron wide, narrowing towards apex, dull with scales along outer margin.

Pygidium. Subnitid with scattered small punctures each with a short appressed, elongate scale.

Ventral surface and legs. Abdominal segments, metasternum, and mid and hind legs subnitid, femora, centre of metasternum and abdominal segments with scattered fine punctures, each with a short, appressed, flattened seta, more scale-like on abdominal segments and apical margins of metafemora.

Male genitalia as in Fig. 5F.

COMMENTS. *Australoxenella humptydooensis* is closest to *A. mirreen* which was taken slightly south of the former, in Litchfield National Park. *Australoxenella humptydooensis* was taken in numbers using both flight interception and malaise traps, in open and closed forest habitats.

DISCUSSION The 11 species of *Australoxenella* fall into two groups separated in the first couplet of the key. Group 1 consists of *A. bathurstensis*, *A. zborowskii*, *A. concinna*, *A. teeta*, *A. wurrook*, and *A. moogoon* . All have the sculptured area of the pronotum in front of the transverse sulcus of a constant height with the centre five grooves of equal depth and the four ridges of equal height; all but *A. teeta* have the elytral epipleura wide to the apex; the epipleura are subnitid to nitid in all species; in *A. zborowskii*, *A. concinna*, *A. wurrook* and *A. moogoon* the elytra are relatively broad, the ridges and U-shaped depressions not strongly developed, and the crest of each ridge is marked by a distinctive single row of adjacent circular scales. Group 2, containing *A. midgee, A. kalpara, A. peckorum, A. mirreen* and *A. humptydooensis*, always has the middle two anterior pronotal ridges developed into a prominence similar to the posterior prominence but lower; the elytral epipleura are always distinctly narrowed towards the apex and not strongly nitid; the elytra are more convex in cross

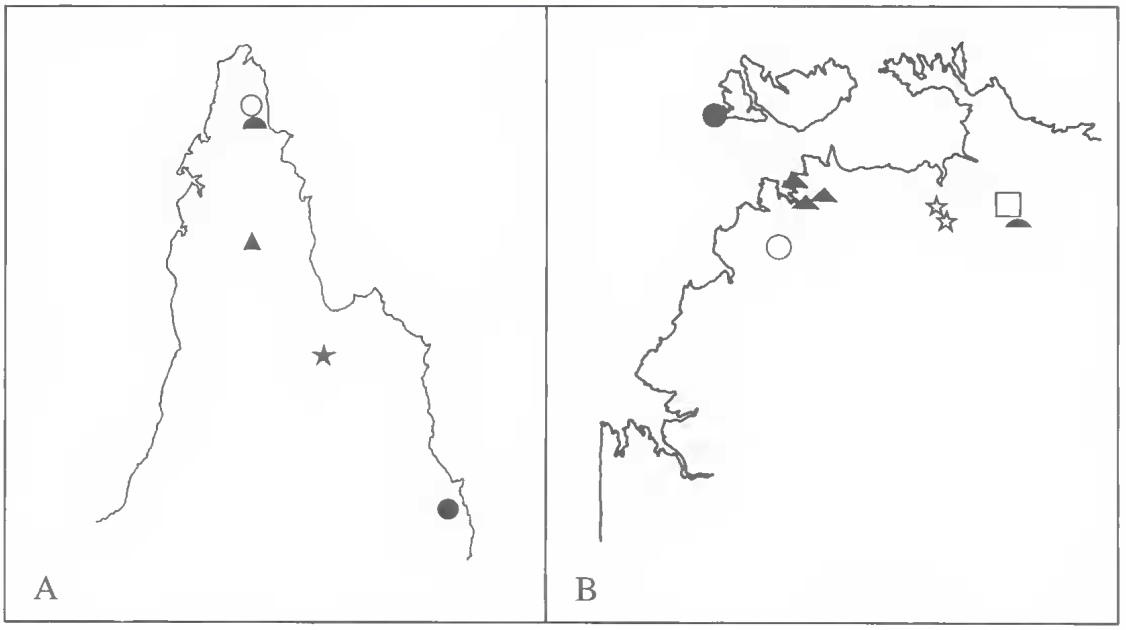

FIG.6. Distribution of *Australoxenella* spp. A, North Queensland: (●) *A. concinna* sp. nov.; (○) *A. zborowskii* sp. nov.; (solid semicircle) *A. midgee* sp. nov.; (★) *A. kalpara* sp. nov.; (▲) *A. teeta* sp. nov. B, Northern Territory: (●) *A. bathurstensis* Howden and Storcy; (□) *A. wurrook* sp. nov.; (solid semicircle) *A. moogoon* sp. nov.; (☆) *A. peckorum* sp. nov.; (○) *A. mirreen* sp. nov.; (▲) *A. humptydooensis* Howden and Storey.

section and the ridges and U-shaped depressions more strongly developed; the crests of the elytral ridges usually do not have a distinctive row of adjacent circular scales. Both species groups occur in N.T. and Qld.

The following are comments on characters employed by Howden & Storey (1992): 17. Absence of striae. *Australoxenella* was rated apomorphic (striae absent) in this character despite all but one of the new species and the two original species having an elytral feature which was thought to be a 'stria'. The exact derivation of this stria-like feature is unknown.

18. Less than five abdominal segments at midline. The abdominal segments in *Australoxenella* are greatly compacted and reduced at the mid-line (except the large last visible segment), and discerning the exact number is difficult. The number varies with sex, four in males and five in females.

Except for these features, all new species otherwise agree with the character-states table for *Australoxenella* of Howden & Storey (1992). Bordat & Howden (1995) described three new genera in the tribe from Borneo and discussed the phylogeny of the Stereomerini, removing the South American *Termitaxis* Krikken.

Specimens of *Australoxenella* have been taken in closed (rainforest) and open forest situations (c.1/3 in the former). Six species were taken only in closed forest, two only in open forest, two in both, with no information available for one species. Both habitat types produced specimens in N.T. and Qld. As most specimens were obtained using flight interception traps, it would seem that collection site data reflect habitat preferences of the beetles. There was some evidence in the long N.T. series that catches were higher in traps where some odour of decay was evident, the traps having been run for several weeks.

Australoxenella is still rare in collections. Six species are only represented by the holotype. However, the long series of *A. humptydooensis* and *A. peckorum* indicate that at least these species can be common under some circumstances.

There is no information available on the biology of *Australoxenella*. Howden & Storey (1992) speculated that all Stereomerini were termitophiles and the unusual morphology, specialised pronotal setae in some species and rarity all point to the genus being inquiline. The only direct evidence of termite species being the hosts, was that the only known South American specimen of the tribe, the holotype of *Termitaxis holmgreni* Krikken was taken in the nest of a termite (Krikken, 1970). Bordat & Howden (1995) suggested

that *Termitaxis* should be removed from Stereomerini until the holotype could be closely examined. Though some work has been undertaken investigating termite nests and their associated fauna in tropical areas of Australia, no *Australoxenella* specimens have been found.

ACKNOWLEDGEMENTS

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